

United States Nuclear Regulatory Commission Official Hearing Exhibit	
In the Matter of: Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3)	
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SITE SPECIFIC MACCS2 INPUT DATA FOR INDIAN POINT ENERGY CENTER Revision 1

December 1, 2009

SITE SPECIFIC MACCS2 INPUT DATA FOR
INDIAN POINT
ENERGY CENTER
Revision 1

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1.0 INTRODUCTION

The Severe Accident Mitigation Alternatives (SAMAs) for the Indian Point Energy Center (IPEC) uses the MELCOR Accident Consequence Code System, Version 2 (MACCS2), for estimating the health and economic consequences of severe accidents. Should a severe reactor accident occur, downwind populations, buildings, and crops would be exposed to radioactive materials. MACCS2 estimates the range and probability of the health effects and the economic costs and losses that would result from such an accident.

Data used in this SAMA were imported and organized using ESRI ArcGIS 9.1 Geographic Information System (GIS) (Reference 1.1). ArcGIS 9.1 was used for all geographic processing, overlays, and map production occurred within the ArcGIS 9.1 framework.

MACCS2 requires data in sixteen equiangular sectors centered on IPEC, extending to 50-mile radius. The sector grid is divided into spatial elements by superimposing fifteen circles of increasing diameter over sixteen sectors, for a total of 240 spatial elements. These circles are 0.2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, and 50 miles from IPEC. For the purposes of this report, the IPEC center point was determined as the center of the super-heater stack. Census 2000 Line Data via ESRI (Reference 1.2) for fourteen counties in New York, ten counties in New Jersey, three counties in Connecticut, and one county in Pennsylvania within the IPEC 50-mile buffer were used as base map layers (Figure 1.1, Table 1.1).

Data input into MACCS2 code include:

1. Population in 2035-at the end of the license renewal period for 240 spatial elements.
2. Land Fraction-proportion of each of the 240 spatial elements that is land, not water.
3. Watershed Index-indication of whether spatial element is drained by rivers or is a lake/water body.
4. Regional Economic Data-estimation of amount of farming and economic activities.
5. Agricultural Data-crop types, growing season, and percent of farmland for each crop.



Figure 1.1 US counties within 50-miles of IPEC.

Table 1.1 Counties within 50-miles of IPEC.

<i>State/County</i>	<i>Land Area (square miles)</i>	<i>Percent within 50-mile zone</i>
<i>Connecticut</i>		
Fairfield	620	100.0
Litchfield	907	41.5
New Haven	595	32.9
<i>New Jersey</i>		
Bergen	231	100.0
Essex	122	100.0
Hudson	44	100.0
Middlesex	306	1.8
Morris	451	80.8
Passaic	185	100.0
Somerset	304	4.5
Sussex	515	93.9
Union	102	92.9
Warren	356	0.5
<i>New York</i>		
Bronx	41	100.0
Dutchess	793	88.9
Kings	67	100.0
Nassau	269	97.9
New York	23	100.0
Orange	812	100.0
Putnam	226	100.0
Queens	106	100.0
Richmond	56	65.4
Rockland	173	100.0
Suffolk	895	21.3
Sullivan	967	36.3
Ulster	1123	58.1
Westchester	430	100.0
<i>Pennsylvania</i>		
Pike	540	18.7

County	2000	2004	2010	2015	2020	2025	2030	2035
<i>New York</i>								
Bronx	1,332,650	1,365,536	1,425,170	1,469,206	1,511,322	1,550,580	1,586,661	1,634,750
Dutchess	280,150	293,395	293,520	299,468	304,815	309,007	311,809	319,391
Kings	2,465,326	2,475,290	2,531,424	2,554,579	2,571,602	2,580,325	2,580,903	2,618,418
Nassau	1,334,544	1,339,641	1,312,166	1,300,125	1,290,328	1,278,213	1,260,336	1,251,644
New York	1,537,195	1,562,723	1,587,098	1,600,353	1,606,718	1,605,202	1,595,353	1,570,657
Orange	341,367	370,352	370,521	386,015	401,414	415,973	429,580	445,234
Putnam	95,745	100,570	103,786	107,436	110,891	113,917	116,428	120,738
Queens	2,229,379	2,237,216	2,452,109	2,567,898	2,685,206	2,799,559	2,908,709	3,024,717
Richmond	443,728	463,314	505,844	537,493	569,636	600,954	630,683	662,838
Rockland	286,753	293,626	291,706	291,618	290,732	288,593	284,768	278,799
Suffolk	1,419,369	1,475,488	1,456,195	1,466,808	1,474,746	1,476,069	1,468,072	1,490,766
Sullivan	73,966	76,110	79,522	82,524	85,512	88,362	91,092	94,055
Ulster	177,749	181,779	190,389	197,153	203,871	210,096	215,719	222,655
Westchester	923,459	942,444	926,798	925,714	924,149	919,864	911,278	914,934
<i>Pennsylvania</i>								
Pike	46,302	54,117	60,059	69,447	79,170			103,437

2.2 Projected Transient Population

State tourism agencies were contacted to obtain the most recent tourist (transient) information (Table 2.2). Tourist information for 2004 was not available for Pennsylvania therefore 2003 data was incorporated and was assumed to remain constant for 2004. Fine geographical level tourism data (e.g. tourist per year per county) is not collected by states within 50-mile of IPEC. Connecticut and New Jersey only collect this data at a state level. New York breaks state level visitation numbers into five counties within New York City metropolitan area (defined as Bronx, Kings, New York, Queens, and Richmond counties) and the rest of New York state and Pennsylvania reports tourist per year at a regional level, (Pocono region which includes Carbon, Monroe, Pike and Wayne counties is the relevant region).

To convert state visitation numbers into county visitation the ratio of estimated 2004 county population (Reference 2.5) to estimated 2004 state population was multiplied by total number visitors in state (Table 2.2.1).

Table 2.2.1 State Tourism Offices and Reported Visitor Numbers.

State - Region	Department	Data Year	Reporting Visitor Numbers	Reference Numbers
Connecticut	Connecticut Commission on Culture and Tourism	2004	19,254,000	2.6
New Jersey	New Jersey Travel and Tourism	2004	71,741,000	2.7
New York – New York MSA	NYC & Company	2004	41,000,000	2.8
New York	New York Travel and Tourism	2004	96,000,000	2.9
Pennsylvania - Pocono Region	Visit Pennsylvania - Pennsylvania Tourism Department	2003	17,726,400	2.10

Table 2.2.2 2004 Transient/permanent ratio for 28 reporting counties.

County	2004 Estimated Population	2004 Person Visits (per day)	Transient/Permanent Ratio (per day)
Connecticut			
Fairfield	903,291	13,618	0.015
Litchfield	189,246	2,853	0.015
New Haven	845,694	12,750	0.015
New Jersey			
Bergen	902,998	20,435	0.023
Essex	796,684	18,029	0.023
Hudson	606,240	13,720	0.023
Middlesex	785,095	17,767	0.023
Morris	488,173	11,048	0.023
Passaic	500,427	11,325	0.023
Somerset	316,750	7,168	0.023
Sussex	152,218	3,445	0.023
Union	531,957	12,039	0.023
Warren	110,018	2,490	0.023
New York			
Bronx	1,365,536	18,927	0.014
Dutchess	293,395	6,904	0.024
Kings	2,475,290	34,309	0.014
Nassau	1,339,641	31,525	0.024
New York	1,562,723	21,661	0.014
Orange	370,352	8,715	0.024
Putnam	100,570	2,367	0.024
Queens	2,237,216	31,010	0.014
Richmond	463,314	6,422	0.014
Rockland	293,626	6,910	0.024
Suffolk	1,475,488	34,722	0.024
Sullivan	76,110	1,791	0.024
Ulster	181,779	4,278	0.024
Westchester	942,444	22,178	0.024
Pennsylvania			
Pike	54,117	8,112	0.150

2.3 Projected Total Population

The projected total population within a 50-mile radius of IPEC was estimated for the year 2035, the end of the proposed license renewal period, by combining the 2035 extrapolated permanent population (Table 2.3) with 2035 extrapolated transient population. The 2035 extrapolated transient population was assumed to be the 2004 transient/population ratio multiplied by the extrapolated permanent population (Table 2.3).

Table 2.3 Projected total population (2035) by county.

County	Transient/Permanent Ratio	2035 Projected Permanent Population	2035 Projected Total Population
Connecticut			
Fairfield	0.015	918,600	932,828
Litchfield	0.015	217,309	220,675
New Haven	0.015	896,364	910,248
New Jersey			
Bergen	0.023	1,089,428	1,114,876
Essex	0.023	868,715	889,007
Hudson	0.023	690,981	707,121
Middlesex	0.023	1,053,511	1,078,120
Morris	0.023	653,201	668,459
Passaic	0.023	553,404	566,330
Somerset	0.023	470,131	481,112
Sussex	0.023	217,947	223,038
Union	0.023	590,616	604,412
Warren	0.023	156,074	159,719
New York			
Bronx	0.014	1,634,750	1,657,680
Dutchess	0.024	319,391	327,050
Kings	0.014	2,618,418	2,655,145
Nassau	0.024	1,251,644	1,281,658
New York	0.014	1,570,657	1,592,688
Orange	0.024	445,234	455,910
Putnam	0.024	120,738	123,633
Queens	0.014	3,024,717	3,067,143
Richmond	0.014	662,838	672,135
Rockland	0.024	278,799	285,484
Suffolk	0.024	1,490,766	1,526,514
Sullivan	0.024	94,055	96,310
Ulster	0.024	222,655	227,994
Westchester	0.024	914,934	936,873
Pennsylvania			
Pike	0.15	103,437	120,669

2.4 Projected Total Population by Spatial Element

Areal weighting was used to transfer 2035 projected total population from source areas (county) to target areas (spatial elements) by converting county population to a density measure (e.g. number of people in county/acre) and multiplying this density by the area that county has in a spatial element. For spatial elements that are comprised of elements of more than one county, individual county densities were multiplied by areas of each county in a spatial element and summed. Total projected population of the 50-mile zone of analysis is 19,228,712 and the distribution of 2035 total population is summarized in Table 2.4 and illustrated in Figure 2.2.

Table 2.4 2035 projected total population summarized by wind direction and buffer distance.

Wind Direction	0 to 10 miles	11 to 20 miles	21 to 30 miles	31 to 40 miles	41 to 50 miles	Total
N	12,488	22,955	30,654	39,620	51,057	156,774
NNE	14,952	28,140	39,917	56,226	67,213	206,448
NE	23,377	29,419	53,692	62,559	41,261	210,308
ENE	40,386	74,856	119,073	152,175	176,338	562,828
E	41,290	118,335	156,720	200,581	208,394	725,320
ESE	37,861	121,515	144,267	54,180	34,361	392,184
SE	41,873	111,946	87,735	236,426	379,990	857,970
SSE	12,197	98,326	481,703	1,380,249	1,218,170	3,190,645
S	20,621	135,211	1,164,596	3,732,339	3,164,306	8,217,073
SSW	30,318	202,605	395,389	922,649	1,034,467	2,585,428
SW	30,796	183,372	276,902	197,362	246,076	934,508
WSW	27,723	64,428	209,197	109,102	85,849	496,299
W	16,925	32,026	50,974	61,380	57,384	218,689
WNW	14,036	32,528	54,577	57,977	29,719	188,837
NW	13,421	32,572	54,557	24,046	22,317	146,913
NNW	12,286	31,660	32,569	27,599	34,374	138,488
Totals	390,550	1,319,894	3,352,522	7,314,470	6,851,276	19,228,712

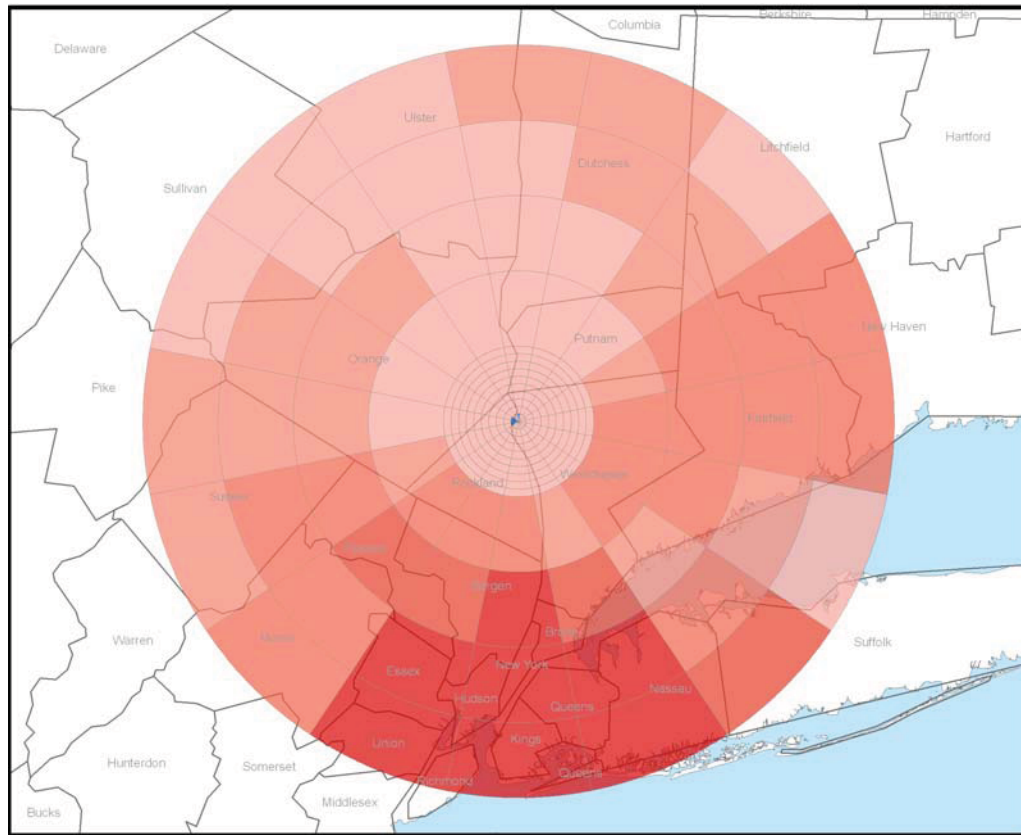


Figure 2.1 2035 projected total population by spatial element (dark red indicates highest population).